

THE MALE GENITALIA OF BLATTARIA.
X. BLABERIDAE. *PYCNOSCELUS*, *STILPNOBLATTA*,
PROSCRATEA (PYCNOSCELINAE), AND
DIPLOPTERA (DIPLOPTERINAE).*

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McKittrick (1964) grouped the Pycnoscelinae, Diplopterinae, Panchlorinae, and Oxyhaloinae, in the Panchloroid Complex of Blaberidae. The male genitalia of the latter two subfamilies have been described (Roth, 1971a, 1971b). In this paper I shall illustrate the male genitalia of several species of Pycnoscelinae and two species of Diplopterinae.

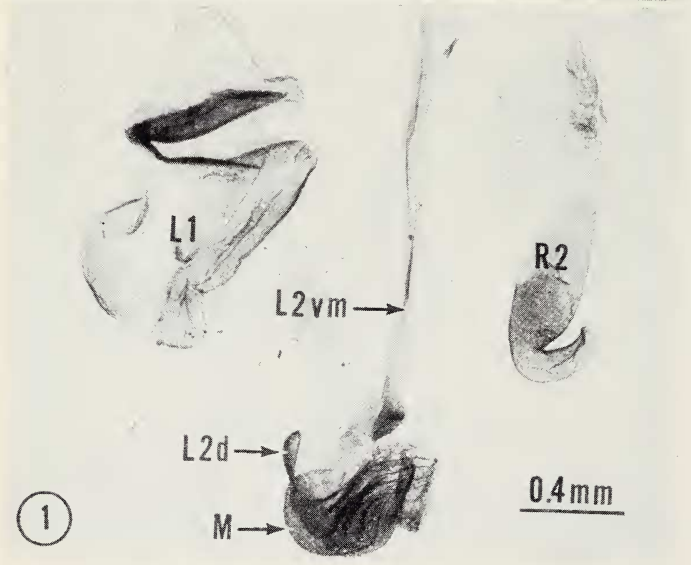
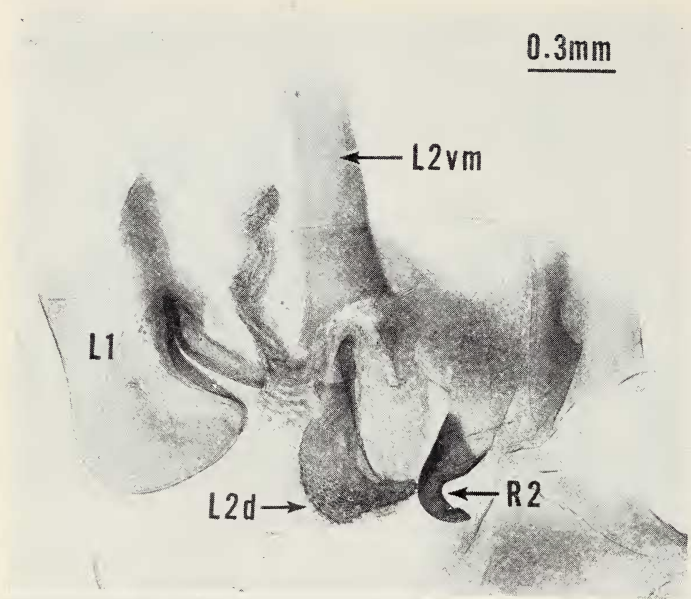
MATERIALS AND METHODS

The genitalia were treated with 10% KOH and mounted in Permout. The source of each of the specimens illustrated is given using the following abbreviations: (ANSP) = Academy of Natural Sciences, Philadelphia; (BMNH) = British Museum (Natural History); (L) = Zoological Institute, Lund, Sweden; (MCZ) = Museum of Comparative Zoology, Harvard University; (VM) = Vienna Museum Natural History, Vienna, Austria. Geographical collection data and the names of specialists who identified the specimens, if known, follow these abbreviations. The number preceding the abbreviation refers to the number assigned to the specimen and its corresponding genitalia (on a slide) which are deposited in their respective museums.

RESULTS AND DISCUSSION
Pycnoscelinae

Pycnoscelus surinamensis (Linn.) is the type species but it is parthenogenetic and normally only exists as females. *P. indicus* (Fab.) is bisexual and apparently the parent stock from which *surinamensis* arose. Occasionally parthenogenetic males occur in cultures of *surinamensis* but they are non-functional when mated to parthenogenetic females (Roth, 1967).

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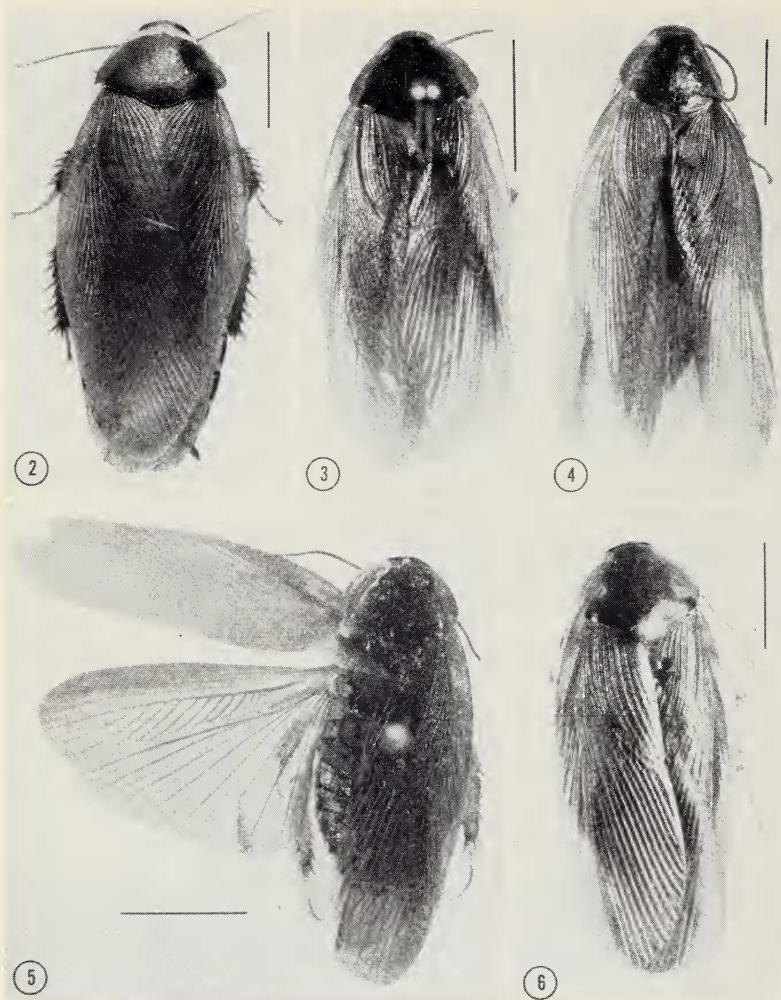


The arrangement of the male genital phallomeres is shown in figure 1. In *Pycnoscelus indicus* all 3 phallomeres are well developed and sclerotized (Figs. 7-9). The L2d is separated from L2vm; the obliquely more or less truncate ends of these 2 sclerotized structures (Figs. 7, 10, 21, 24, 31) have the appearance of having been broken off and separated from L2vm. The outer lower curved portion of L2d is spicular (Figs. 1, 7, 10-13), and the underlying prepuce is densely "hairy" but otherwise not unusually shaped (Fig. 7, P). The curved genital hook (R2) lacks a subapical incision, is heavily sclerotized, somewhat truncate at the apex, the inner curved margin with (Figs. 8, 14-18) or without (Figs. 19-20) small projections. The L1 is very well developed with the cleft turned upward and its margins heavily sclerotized (Figs. 1, 9). The genitalia of *Pycnoscelus surinamensis* (Figs. 21-25), and *Pycnoscelus nigra* (Brunner) (Figs. 31-33) are indistinguishable from those of *P. indicus*. Habitus photographs of *P. indicus* and *P. nigra* are shown in figures 2 and 4.

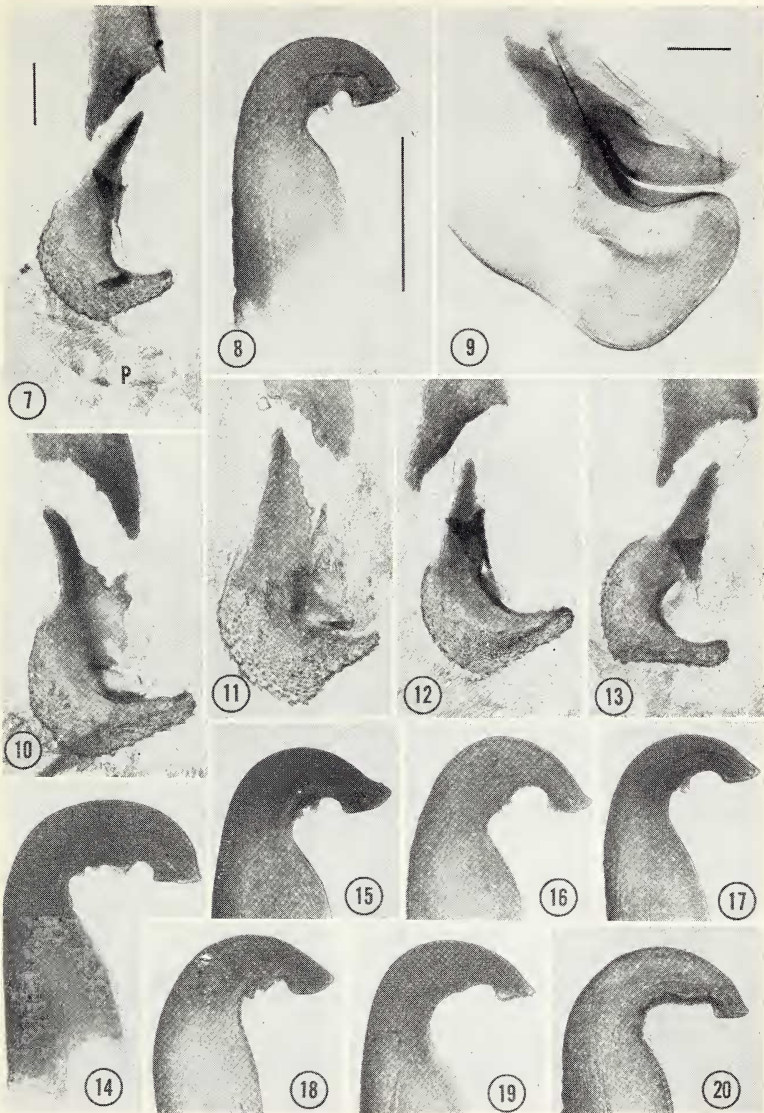
The shapes of the L2d and R2 (Figs. 26, 27, 29, 30) of *Pycnoscelus semivitreus* Princis (Fig. 3) differ from those structures in *P. indicus*, *P. surinamensis*, and *P. nigra*; however, the shape of L1 in all 4 of the above species is similar (cf. Figs. 9, 23, 28, 33 (distorted in preparation)). Two of the genital phallomeres of *Pycnoscelus striata* (Kirby) are distinguishable from those of the other species of the genus. Its L2d (Fig. 34) differs in shape, lacks the spicular surface characteristic of the outer lower curved region and is only slightly separated from L2vm (cf. Fig. 31). The curved portion of R2 (Fig. 35) of *striata* is more elongate and slender than in *semivitreus* (Figs. 27, 29) and more uniform in width than in *P. indicus* (Figs. 14-20) or *nigra* (Fig. 32).

Princis (1964) included *Stilpnoblatta* in the Pycnoscelidae and the genitalia of *S. opaca* (Walker) (Figs. 37-39) tends to support this conclusion, though I relegate his family to subfamily rank (McKittrick, 1964). Especially notable is the marked similarity in appearance of the L1 of *Stilpnoblatta* (Fig. 39) with those of *Pycnoscelus* (Figs. 23, 36). The L2d (Fig. 37) of *S. opaca* is greatly reduced and irregular in outline and is widely separated from

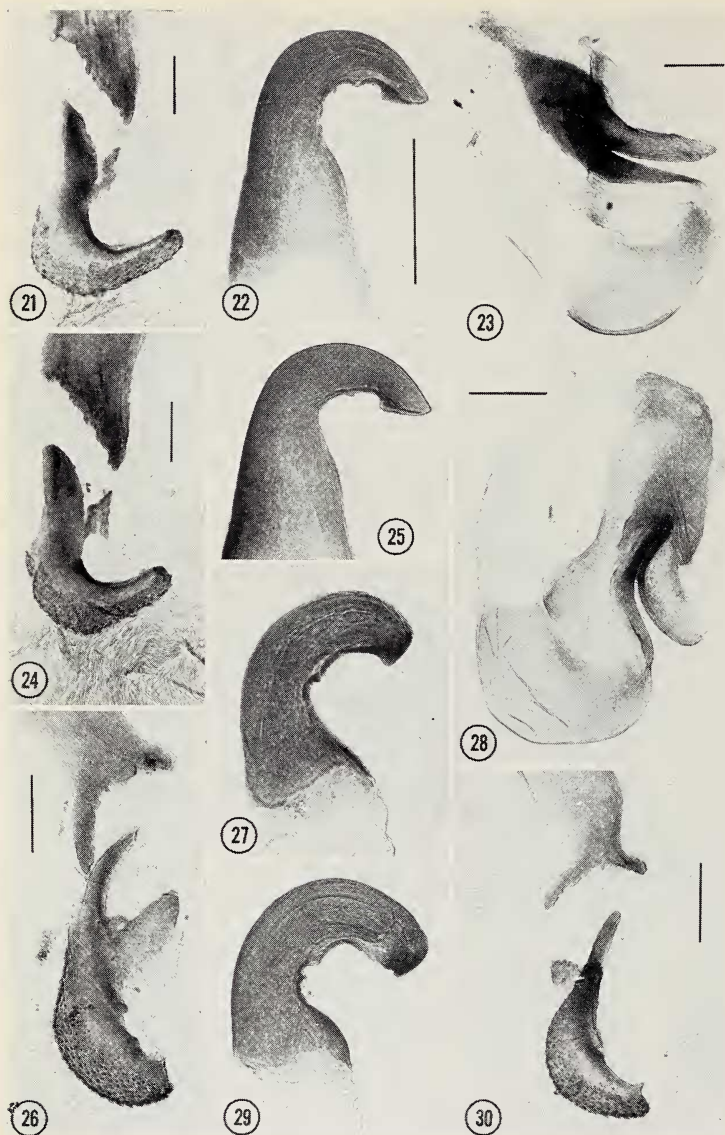
Fig. 1. Male genitalia (dorsal view). Top. (106 MCZ). *Pycnoscelus indicus*. Zamboanga, Philippine Islands. (det. Roth). Bottom. (70 BMNH). *Proscratea complanata*. São Gabriel, Rio Negro, Brazil, 27.IX.1927, J. F. Zikan. (L1 = first sclerite of left phallomere; L2d = dorsal sclerite of L2; L2vm = ventromedial sclerite; M = saclike membrane above L2d; R2 = hooked sclerite of right phallomere).



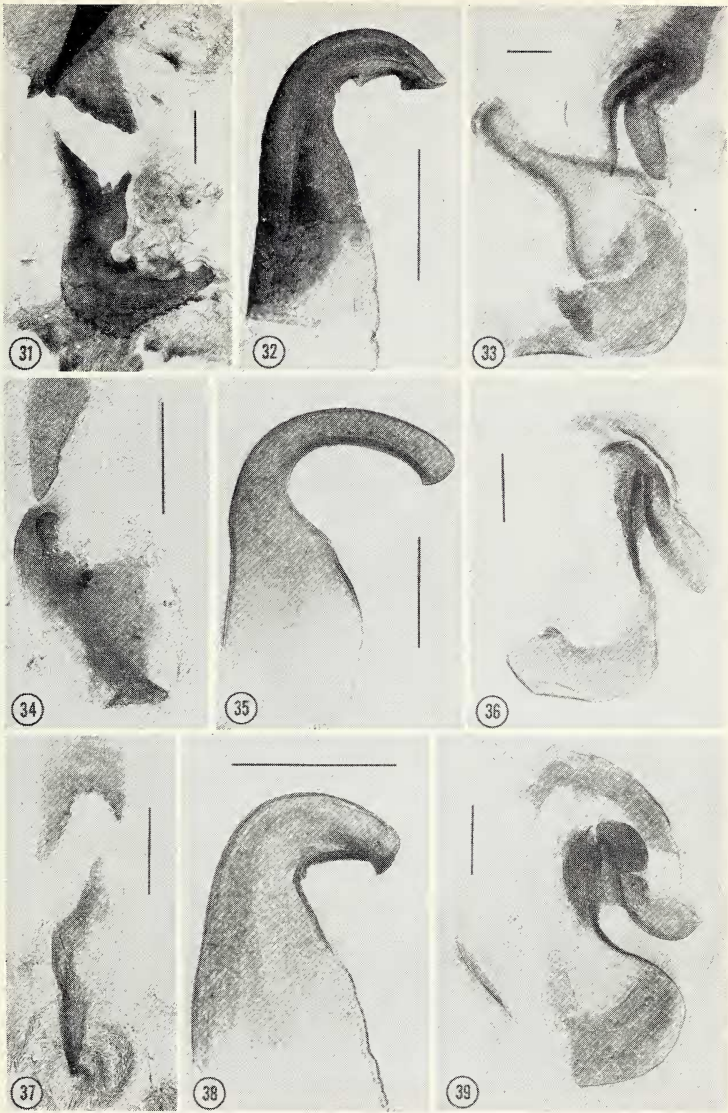
Figs. 2-6. Males of Pycnoscelinae. 2. *Pycnoscelus indicus*. Sakaerat District, Thailand. From a laboratory colony. 3. (100 MCZ). *Pycnoscelus semivitreus*. Manila, Philippine Islands. (det. Princis). This species was described (Princis, 1967, p. 148) from 2 ♂♂ from Java, Depok. 4. (25 BMNH). *Pycnoscelus nigra*. Southwest China, Yunnan, Ho-an (leg. J. W. Gregory, 26.V.1922). 5. (1447 L). *Pycnoscelus striata*. Kariorang, Borneo, (det. Princis). 6. (144 ANSP). *Stilpnoblatta opaca*. Butawa, Modera, S. P. Ceylon (det. by Hebard as *S. bengalensis* (Sauss)). (scale = 5 mm).



Figs. 7-20. Male genital phallomer of *Pycnoscelus indicus*. 7-9. L2d, R2, and L1 from a specimen originating from Hawaii (laboratory culture). P = prepuce. 10-13. L2d's. 10. Sakaerat District, Thailand (laboratory culture). 11. (101 MCZ). Pasay, Philippine Islands. 12-13. Hawaii (laboratory culture). 14-20. R2's. 14. Sakaerat District, Thailand (laboratory culture). 15-19. Hawaii (laboratory culture). 20. (101 MCZ). Pasay, Philippine Islands. (scale = 0.2 mm; figures 10-13 magnified to scale shown in fig. 7; figures 14-20 magnified to scale shown in fig. 8).



Figs. 21-30. Male genital phallomeres of *Pycnoscelus* spp. 21-25. *P. surinamensis*. Two males which occurred in a culture originating from Fraser Island, Australia. 26-30. *P. semivitreus*. 26-28. (102 MCZ). Manila, Philippine Islands (det. Princis). 29-30. (100 MCZ). From ♂ shown in figure 3. (scale = 0.2 mm; figures 25, 27, 29 magnified to scale shown in fig. 22).



Figs. 31-39. Male genital phallomeres of Pycnoscelinae. 31-33. (25 BMNH). *Pycnoscelus nigra*; L1 (Fig. 33) was distorted in preparation. (from ♂ shown in figure 4). 34-36. (1447 L). *Pycnoscelus striata* (from ♂ shown in figure 5). 37-39. (144 ANSP). *Stilpnoblatta opaca* (from ♂ shown in figure 6). (scale = 0.2 mm).

L2vm. The R2 (Fig. 38) is broad, relatively short and, as in *Pycnoscelus*, lacks a subapical incision.

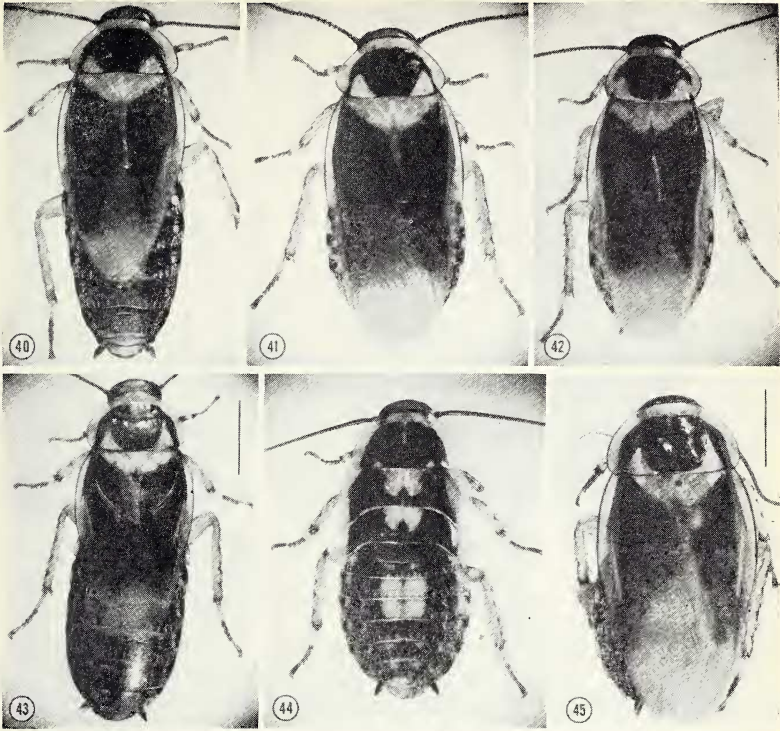
Princis (1964) lists 4 valid species of *Proscratea*: *peruana* Sauss., *inequalis* (Walker), *funebri* Burmeister, and *complanata* (Perty). Brunner (1865) synonymized *P. peruana* with *P. complanata* with a (?) and Kirby (1904) listed them as synonyms. Hebard (1926) placed *funebri* as a synonym of *complanata*, but Rehn (1932) felt that this was not warranted until additional information became available. Princis (1963) concluded that the above synonymies were incorrect, and showed differences in pronotal shapes and color markings of the 4 species. I have examined the type of *P. inequalis* and find that its genitalia are so different from those of *P. complanata* (type of genus) that it undoubtedly does not belong to this genus.

I collected *P. complanata* (det. by Gurney) in Brazil and established a colony which was maintained for several years at the Natick Laboratories. Habitus figures of adults and a nymph (from the culture) are shown in figures 40-44. The adult pronotal markings may vary (Figs. 40-42) (see Rehn, 1932, p. 71) and the pattern of the specimen shown in figure 42 resembles that shown by Princis (1963, p. 148) for *funebri*. The specimen provisionally determined by Rehn as *peruana* has pronotal markings (Fig. 45) similar to *complanata*.

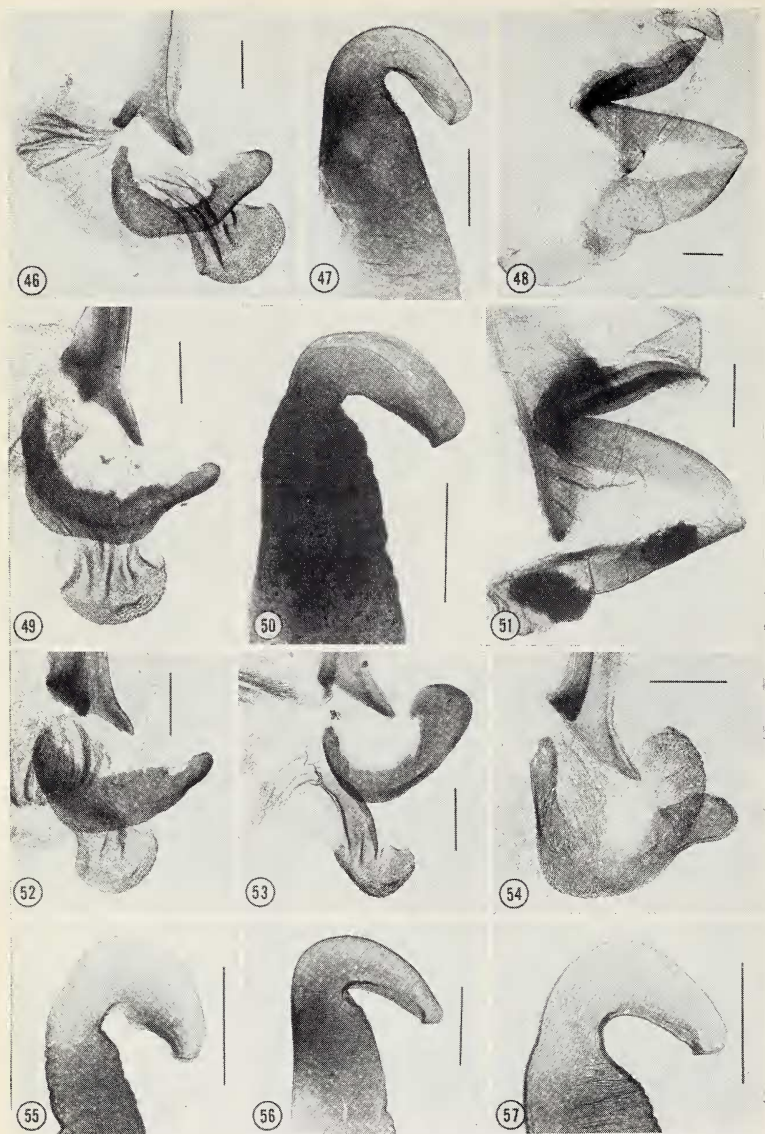
Princis (1964) placed *Panchlora*, *Proscratea*, and *Phortioecoides* in the Panchloridae. Male genitalia clearly place *Phortioecoides* in the Zetoborinae (Blaberidae) (Roth, 1970a). The male phallomeres of the Panchlorinae (5 genera) are notable for their marked reduction or absence (Roth, 1971b, Gurney and Roth, 1972). The genitalia of *Proscratea* are not characteristic of the Panchlorinae.

Hebard (1926) and Rehn (1932) believed that *Proscratea* belonged to that section of the Perisphaeriinae which included *Paranauphoeta* Brunner and its allies. I have examined the male genitalia of 6 species of *Paranauphoeta* and all 3 phallomeres differ markedly from those of *Proscratea*.

McKittrick (personal communication) placed *Proscratea* in the Diplopterinae. However, the shape of the L2d and R2 in *Proscratea* are more like those of *Pycnoscelus* and I tentatively place *Proscratea* in the Pycnoscelinae. McKittrick (1964) shows *Diploptera*, *Leurolestes*, and *Pycnoscelus*, as arising from a common stock. *Phoetalia* (= *Leurolestes*) which she placed with *Diploptera* in the Diplopterinae belongs to the Blaberinae (Roth, 1970b). The shape of the spermatophore of *Proscratea complanata* looks like a bowling pin and strongly resembles the spermatophore of *Diploptera* suggesting a relationship between these 2 genera. However, other genera in



Figs. 40-45. *Proscratea* spp. 40-44. *P. complanata*. From laboratory colony which originated from Serra Tamendauí, Rio Negro, Amazonas. 40. Brachypterous male. 41-42. Macropterous males. 43. Brachypterous female. 44. Female nymph. 45. (129 ANSP). *P. "peruana"* ♂, Hacienda San Juan, Colonio Perené, Peru, June 23, 1920; Cornell Univ. Exped. (det. Rehn). (scale = 5 mm; scale for figures 40-44 shown in fig. 43).



Figs. 46-57. Male genital phallomeres of *Proscratea* spp. 46-48. (129 ANSP). *P. "peruana"* (from ♂ shown in figure 45). 49-57. *P. complanata*. 49-51. Tapurucuara, Rio Negro, Amazonas. 53, 56. Urucurutuba, Rio Madeira, Amazonas. 54, 57. Serra Tamendauí, Rio Negro, Amazonas. (scale = 0.2 mm).

different subfamilies (e.g., *Capucina* [Zetoborinae,] *Nauphoeta* and *Gromphadorhina* [Oxyhaloinae]) have spermatophores (Graves, 1969) somewhat similar in shape to those of *Diploptera* and *Proscratea*.

The L2d of *Proscratea* is well developed, somewhat crescent-shaped (but variable) and widely separated from L2vm (Figs. 46, 49, 52-54). The membrane above L2d is modified to form a sac-like projection whose surface is covered with microspicules; this structure is not found in the other Pycnoscelinae. The R2 is short, stout, and lacks a subapical incision (Figs. 47, 50, 55-57). The shape of the cleft in the L1 of *Proscratea* does not curve upwards (Figs. 48, 51) as it does in *Pycnoscelus* (Fig. 9) or *Stilpnoblatta* (Fig. 39). The genitalia of *Proscratea complanata* (Figs. 46-48) are indistinguishable from the specimen provisionally determined by Rehn (1932, pp. 71-72) to be *Proscratea peruana* (Figs. 49-51).

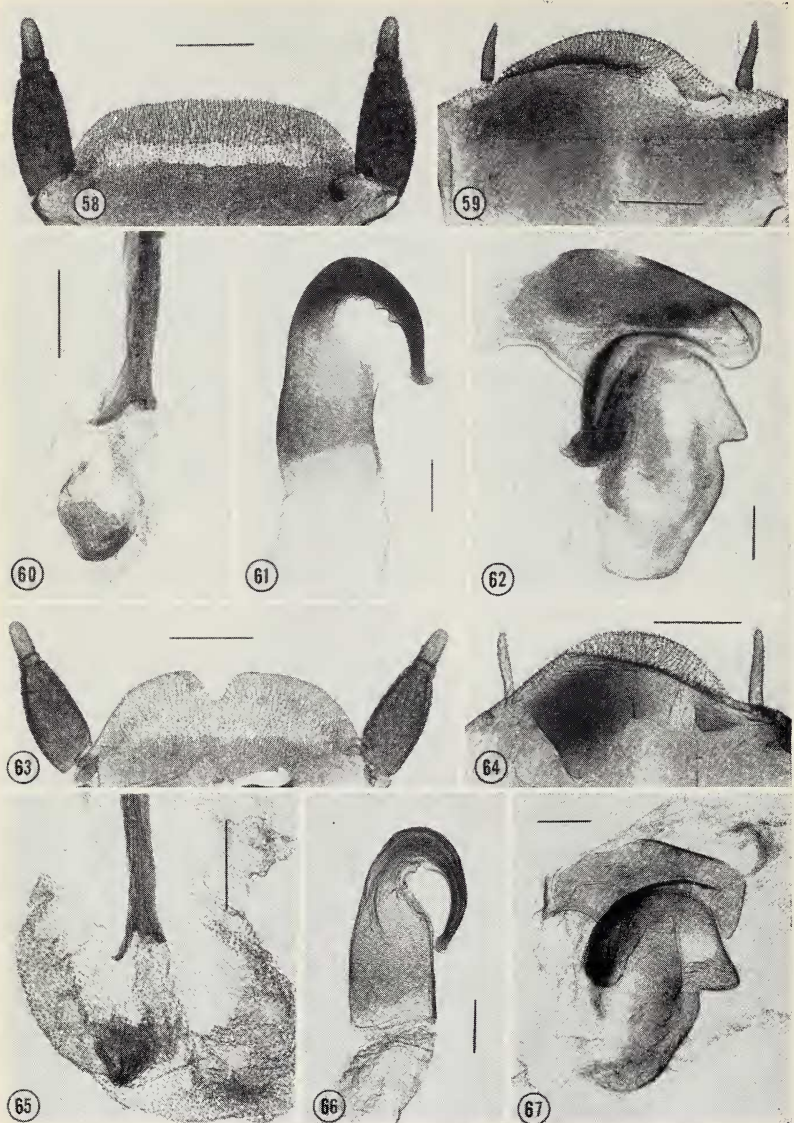
Because of the differences between the L1 and the presence of the modified membrane over the L2d of *Proscratea*, I suggest 2 tribes in this subfamily:

1. Pycnoscelini: *Pycnoscelus*, *Stilpnoblatta*
2. Proscrateini: *Proscratea*

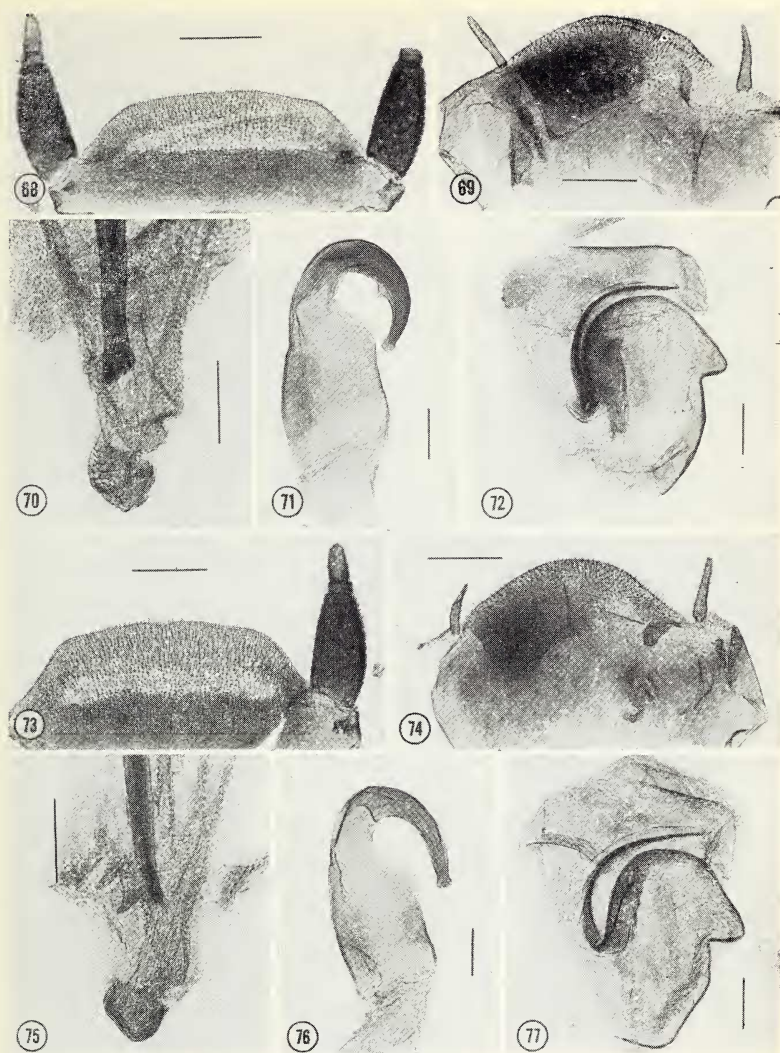
Diplopterinae

Princis (1965) placed the genera *Diploptera* and *Diplopterina* in the Diplopteridae. The genitalia of *Diplopterina* are closer to certain members of the Perisphaeriinae (unpublished observations) and I consider it to be a member of this subfamily. McKittrick (1964) included 2 genera, *Diploptera* and *Phoetalia* (= *Leurolestes*) in Diplopterinae. As indicated above, the genitalia of *Phoetalia* place it in the Blaberinae (Roth, 1970b). *Diploptera punctata* (Eschscholtz) is the only viviparous cockroach known and, at present, I consider this genus to be the only member of the Diplopterinae. Other members of the Blaberidae, whose reproduction has been investigated, are ovoviviparous. Princis (1965) lists 7 species of *Diploptera* and it would be of interest to determine if those, other than *punctata*, are viviparous also.

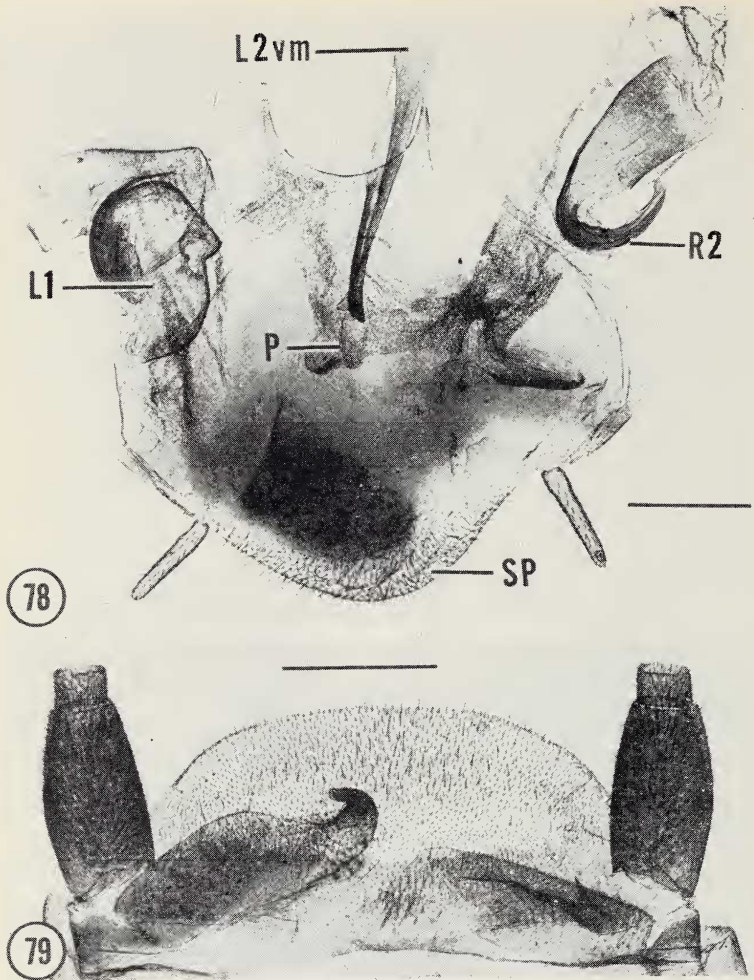
The arrangement of the phallomeres of *Diploptera minor* Brunner is shown in figure 78. The male genital phallomeres of *D. punctata* (type of genus) are shown in figures 60-62. The curved hook (R2) lacks a subapical incision, is more slender and elongate, and more strongly curved (Fig. 61) than in most of the species of Pycnoscelinae. The inner margin of the curved portion of the hook has



Figs. 58-67. Supra-anal and subgenital plates, and genital phallomeres of male *Diploptera* spp. 58-62. *D. punctata* (from laboratory colony originating in Hawaii). 58. Supra-anal plate (dorsal). 59. Subgenital plate (ventral). 60-62. Genital phallomeres. 63-67. (67 BMNH). *D.* sp., Honolulu, Hawaii. 63. Supra-anal plate (dorsal). 64. Subgenital plate (ventral). 65-67. Genital phallomeres. (scale: supra-anal and subgenital plates = 0.5 mm; phallomeres = 0.2 mm).



Figs. 68-77. Supra-anal and subgenital plates, and genitalic phallomeres of *Diploptera* spp. 68-72. (68 BMNH). Samoa Island. 68. Supra-anal plate (dorsal). 69. Subgenital plate (ventral). 70-72. Genitalic phallomeres. 73-77. (69 BMNH). Henderson Island, South Pacific. 73. Supra-anal plate (dorsal). 74. Subgenital plate (ventral). 75-77. Genitalic phallomeres. (scale: supra-anal and subgenital plates = 0.5 mm; phallomeres = 0.2 mm).



Figs. 78-79. (17 VM). *Diploptera minor*. Type ♂, Philippines. 78. Genitalia and subgenital plate (SP) (ventral). P = prepuce; other abbreviations as in figure 1. 79. Supra-anal plate (dorsal). The terminal segments of the cerci were missing. The paraprocts are visible beneath the supra-anal plate in the cleared specimen. (scale = 0.5 mm).

minute undulating irregularities reminiscent of some specimens of *P. indicus* (cf. Fig. 61 with Figs. 14-15, 18). The L2d is apparently represented by a small sclerotized region of the prepuce widely separated from the apex of L2vm (Fig. 60). The vertical downward curvature of the cleft and indentation on the outer margin of the lower lobe of L1 (Fig. 62) is unique for this phallomere in the Blaberidae; the lower lobe of L1 lacks setae.

The supra-anal and subgenital plates of *D. punctata* are shown in figures 58-59. The genital phallomeres of 3 other undetermined specimens of *Diploptera* (Figs. 65-67, 70-72, 75-77) are indistinguishable from *D. punctata*. The subgenital plates of these specimens (Figs. 64, 69, 74) are similar to *D. punctata* (Fig. 59), but the shapes of the supra-anal plate of 2 of the specimens differ somewhat. In the specimen shown in figure 63, there is a deep invagination on the posterior margin; however because of the slight asymmetry of the indentation this may be an aberrant *punctata*. This specimen is from Hawaii and although *D. punctata* is widespread in the Pacific it is the only species of the genus recorded from Hawaii (Princis, 1965). Except for size, the phallomeres (fig. 78) of *D. minor* are almost indistinguishable from *D. punctata*; the sclerotization (L2d) of the prepuce found in *D. punctata* is absent in *minor*. The supra-anal plate of *D. minor* is slightly more rounded (fig. 79) than that of *punctata* (fig. 58).

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